ECONOMIC BURDEN OF CLASSICAL HOMOCYSTINURIA IN THE UNITED STATES

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Poster# 48

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RESULTS

Patient Demographics

- There were 150 patients who met the inclusion criteria and 143 who had a tHcy level (**Figure 1**)
- In the overall cohort with a tHcy level (n=143), 44.1% of patients were female, mean age was 47.8 years, and 76.9% of patients were White (**Table 1**)
- Gender was similar across tHcy stratifications, and most patients were White in all tHcy stratifications (**Table 1**)
- Mean age was slightly lower in patients with higher tHcy levels (<50 µM, 50.6 years vs ≥50 µM, 45.7 years and 50-<100µM, 48.2 years vs ≥100 µM, 41.1 years) (**Table 1**)
- Mean baseline Charlson comorbidity indices were higher in patients with higher tHcy levels (≥100 µM, 2.5; 50-<100µM, 1.3; <50 µM, 0.8) (**Table 1**)

Unadjusted Mean All-Cause Costs

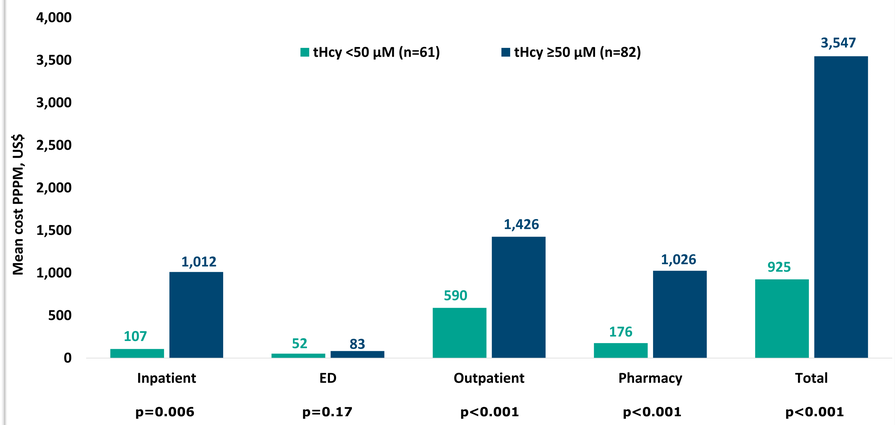
- Among the overall cohort with a tHcy level (n=143), mean total health care costs PPPY were $29,565
- In general, patients in higher tHcy groups (≥50 µM and ≥100 µM) had higher mean all-cause health care costs compared with those with lower tHcy levels (<50 µM and 50-<100 µM)
- Mean total health care costs PPPM were $3,547 in patients with tHcy ≥50 µM (PP, $100,220) and $925 (PP, $30,546) in patients with tHcy <50 µM (p<0.001) (**Figure 2**)
- A major portion of the costs in patients with tHcy ≥50 µM were related to outpatient visits (mean PPPM, $1,426), followed by pharmacy claims (mean PPPM, $1,026) and inpatient admissions (mean PPPM, $1,012) (**Figure 2**)

Table 1. Patient Demographics and Clinical Characteristics

			tHcy ≥50 µM (n=82)		
	Overall with a tHcy level (n=143)	tHcy <50 µM (n=61)	Total tHcy ≥50 µM (n=82)	tHcy 50-<100 µM (n=54)	tHcy ≥100 µM (n=28)
Gender, female, No. (%)	63 (44.1)	28 (45.9)	35 (42.7)	23 (42.6)	12 (42.9)
Age at index (continuous), y					
Mean (SD)	47.8 (19.2)	50.6 (19.3)	45.7 (19.0)	48.2 (17.5)	41.1 (21.2)
Age at index (categorical), y, No. (%)					
<10	7 (4.9)	2 (3.3)	5 (6.1)	3 (5.6)	2 (7.1)
<18	11 (7.7)	3 (4.9)	8 (9.8)	5 (9.3)	3 (10.7)
18-44	48 (33.6)	15 (24.6)	33 (40.2)	18 (33.3)	15 (53.6)
45-64	56 (39.2)	28 (45.9)	28 (34.1)	23 (42.6)	5 (17.9)
65-74	18 (12.6)	8 (13.1)	10 (12.2)	6 (11.1)	4 (14.3)
≥75	10 (7.0)	7 (11.5)	3 (3.7)	2 (3.7)	1 (3.6)
Race, No. (%)					
African American	18 (12.6)	7 (11.5)	11 (13.4)	9 (16.7)	2 (7.1)
Asian	2 (1.4)	0 (0.0)	2 (2.4)	2 (3.7)	0 (0.0)
White	110 (76.9)	49 (80.3)	61 (74.4)	40 (74.1)	21 (75.0)
Other/Unknown	13 (9.1)	5 (8.2)	8 (9.8)	3 (5.6)	5 (17.9)
Follow-up time, months,* median (Q1, Q3)	32.8 (18.8, 46.7)	39.2 (19.9, 54.6)	27.6 (16.7, 43.6)	27.6 (19.7, 41.6)	27.6 (13.5, 45.2)
Charlson comorbidity index, mean (SD)	1.3 (1.8)	0.8 (1.2)	1.7 (2.0)	1.3 (1.6)	2.5 (2.4)

Abbreviations: Q1, 1st quartile; Q3, 3rd quartile; SD, standard deviation; tHcy, total homocysteine; y, years.
*Time based on continuous enrollment. Because of rounding, percentages may not total 100.

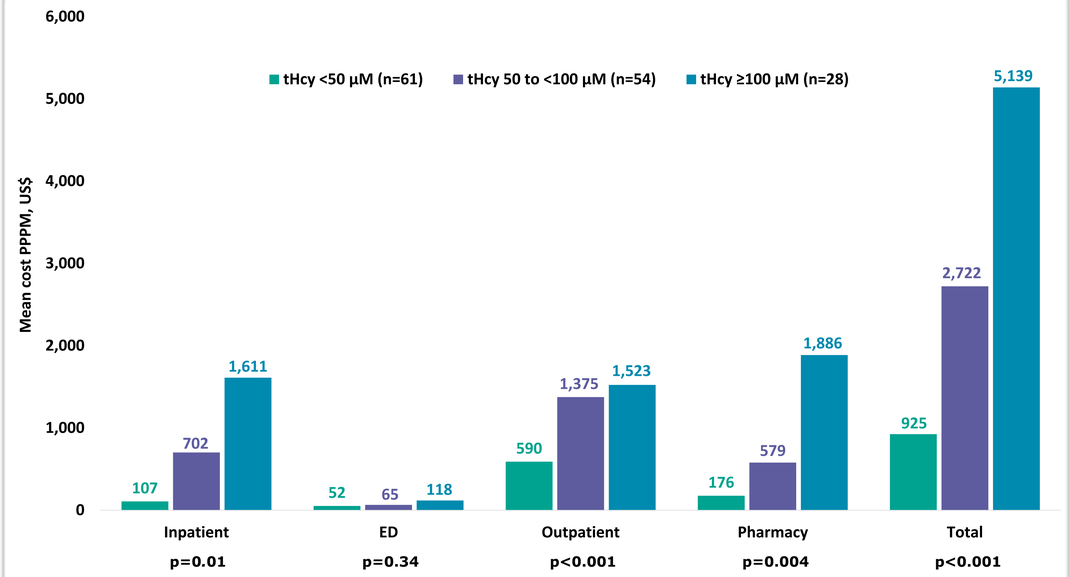
Figure 2. Mean All-Cause Costs Per Patient Per Month by tHcy <50 µM Compared With tHcy ≥50 µM



Abbreviations: ED, emergency department; PPPM, per patient per month; tHcy, total homocysteine. p values are comparing the <50 µM and ≥50 µM tHcy groups.

- Mean total health care costs PPPM were $5,139 (PP, $137,681) in patients with tHcy ≥100 µM and $2,722 (PP, $80,796) in patients with tHcy 50-<100 µM (p<0.001) (**Figure 3**)
  - A major portion of the costs in patients with tHcy ≥100 µM were related to pharmacy claims (mean PPPM, $1,886), followed by inpatient admissions (mean PPPM, $1,611), and outpatient visits (mean PPPM, $1,523) (**Figure 3**)

Figure 3. Mean All-Cause Costs Per Patient Per Month by tHcy <50 µM vs tHcy 50 to <100 µM vs tHcy ≥100 µM



Abbreviations: ED, emergency department; PPPM, per patient per month; tHcy, total homocysteine. p values are comparing the <50 µM, 50-<100 µM, and ≥100 µM tHcy groups.

CONCLUSIONS

- The economic burden of HCU is substantially higher at higher tHcy levels, especially above 50µM and 100µM
- These data suggest that lowering tHcy levels through appropriate diet and treatment could significantly reduce the overall economic burden of HCU

DISCLOSURES

MJ: has received consultancy fees from Travere Therapeutics, Inc.; **LP:** is a former employee and stockholder of Travere Therapeutics, Inc.; **MS:** is an employee and stockholder of Travere Therapeutics, Inc.; **AR, CNM, DA:** are employees of Genesis Research Group, which receives consulting fees from Travere Therapeutics, Inc. for conducting this study and providing medical writing support.

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ABBREVIATIONS

CKD, chronic kidney disease; **ED,** emergency department; **ESKD,** end-stage kidney disease; **HCU,** classical homocystinuria; **ICD-10,** International Classification of Diseases, Tenth Revision; **mo,** month; **No.,** number; **PP,** per patient; **PPPM,** per patient per month; **PPPY,** per patient per year; **Q1,** 1st quartile; **Q3,** 3rd quartile; **SD,** standard deviation; **SDS,** signs, disease, and symptoms; **tHcy,** total homocysteine; **US,** United States; **y,** years.

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INTRODUCTION

- Classical homocystinuria (HCU) is a rare genetic disorder caused by cystathionine β-synthase deficiency and characterized by elevated total homocysteine (tHcy) levels[1,2]
- Increased levels of tHcy are associated with higher frequency of clinical events affecting the vascular, nervous, ocular, and skeletal systems[3]
- Limited research exists utilizing claims data to determine the health care costs associated with HCU, stratified by tHcy levels

Objective

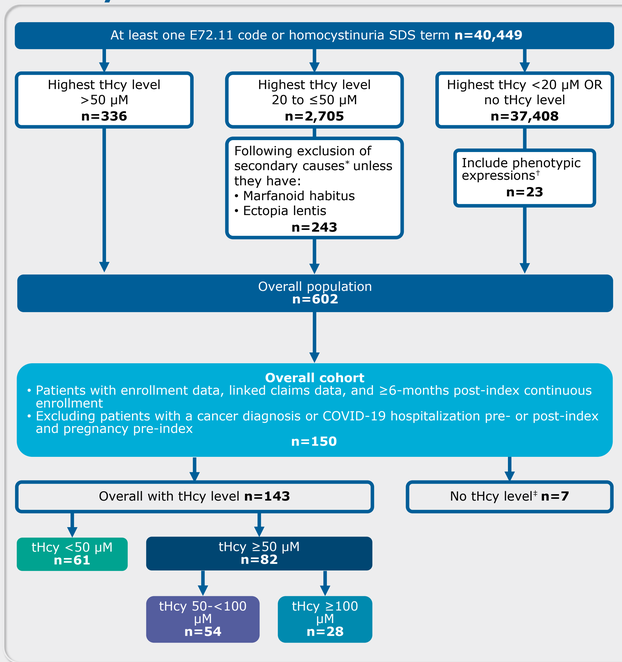
- Using claims data, we aimed to estimate and describe the all-cause health care costs in the HCU population in the United States (US), stratified by tHcy levels

METHODS

Data Source and Study Design

- This was a retrospective analysis using Optum's de-identified Market Clarity Data (Market Clarity), which deterministically links medical and pharmacy claims with electronic health record data
- Study period: January 01, 2016, through September 30, 2021
- HCU patients were selected using an algorithm encompassing an ICD-10 diagnosis code, clinical and phenotypic characteristics, and tHcy level (**Figure 1**)
- Patients were included if they had ≥1 ICD-10 diagnosis code for homocystinuria (E72.11) or *homocystinuria* signs, disease, and symptoms (SDS) term in the Market Clarity dataset, a tHcy level during the study period, ≥6 months of follow-up with continuous enrollment, and linked claims data
- The index date was the date on which the first criterion for HCU identification was met, within the identification period

Figure 1. Algorithm Used to Identify Patients with Classical Homocystinuria



Abbreviations: CKD, chronic kidney disease; ESKD, end-stage kidney disease; mo, month; SDS, signs, disease, and symptoms; tHcy, total homocysteine.
***Secondary causes; At any time:** Megaloblastic anemia, disorder of cobalamin metabolism, folate deficiency, CKD, ESKD, renal transplant, diabetes, hypothyroidism; **Within 12 mo:** Myocardial infarction.
†**Phenotypic expressions:** 1. Ectopia lentis AND (cerebrovascular thrombotic/thromboembolic event OR neurologic feature) exclude: Marfanoid habitus, sulfite oxidase deficiency (E72.19); 2. Pectus excavatum AND (cerebrovascular thrombotic/thromboembolic event OR [any thrombotic/thromboembolic event AND neurologic feature]) exclude: Marfanoid habitus, sulfite oxidase deficiency (E72.19); 3. Marfanoid habitus AND cerebrovascular thrombotic/thromboembolic event AND neurologic feature AND (ectopia lentis OR pectus excavatum) exclude: Sulfite oxidase deficiency (E72.19).
‡Patients with outlier (≥3,000 µM) tHcy levels only (no other tHcy level) were considered as having no tHcy level for the stratifications and thus excluded from assessment of the tHcy subgroups.

Study Design (Continued)

- Patients were excluded if they had secondary causes of elevated tHcy, a cancer diagnosis or COVID-19 hospitalization during the study period, or pregnancy pre-index
- Unadjusted all-cause mean total health care costs per patient per year (PPPY) were calculated
- Unadjusted all-cause mean health care costs were also expressed as per patient per month (PPPM) and per patient (PP) over the follow-up period, with patients stratified by highest observed tHcy level (<50 µM vs ≥50 µM and <50 µM vs 50-<100 µM vs ≥100 µM) at any time during the study period
- Costs were inflation-adjusted to 2021 US dollars by applying the medical care commodities component of the Consumer Price Index
- Comparisons were assessed using unadjusted linear regression with a generalized estimating equation

DISCUSSION

- All-cause health care costs for patients with HCU were highest in patients with higher tHcy levels
  - Costs for patients with tHcy levels of 50 to <100 µM were found to be substantial, suggesting that lowering tHcy below 50 µM may reduce health care costs
- A major portion of these costs came from inpatient, outpatient, and pharmacy costs
- In our study, mean total health care costs PPPY in patients with HCU were more than double the estimate of health care costs per person of the general US population in 2021 ($12,914)[4]

Limitations

- Generalizability to the broader US population may be limited
- Market Clarity uses standard pricing algorithms to account for variability across health plans, provider contracts, and regions
- Out-of-pocket, indirect, and informal caregiving costs are not included
- The ICD code used in the patient identification algorithm may have over-captured patients with HCU as it is not specific to HCU
- Clinical events may be underestimated as data on newborn screening in US-based databases are limited. Therefore, the study may not be capturing patients' initial diagnoses, limiting the amount of follow-up used to assess rates of events.

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